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ABSTRACT

Analysis of data from four courses shows that (1) female open learning students complete their courses more often than male counterparts, (2) open learning students who register at certain campuses complete their courses more often than students who register at others, and (3) students who complete and return assigned questionnaires are more likely to complete courses than students who do not. From these data two formulae are derived which predict the number of student withdrawals. After being tested and refined, the two formulae are unified into one weighted index. Subsequent trials of the unified index result in seven of eight predictions being within (+ or -) 10%. Predictions were accurate over different presentation media. (WBC)

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# PREDICTING STUDENT WITHDRAWALS IN OPEN LEARNING COURSES

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## INTRODUCTION

Open learning courses raise a number of research and evaluation issues. This is partly explained by the much more comprehensive instructional design characteristics of open learning courses compared to conventional classroom instruction. One question which has been pursued at Chicago's TV College over the years has been an accurate prediction of completion rates--both overall and individual.

In 1973, a cooperative arrangement between the City Colleges of Chicago and the University of Chicago's Measurement, Evaluation, and Statistical Analysis (MESA) Program brought two part time research interns to work on a variety of evaluation issues at TV College. The need to tag students according to their potential for completion of the TV College courses was given high priority.

An instrument was developed which attempted to assess such things as attitudes toward television-based instruction, studying at home, and some thirty other factors which were felt relevant for separating those who might drop out from those who would not. Results using the attitude instrument were inconclusive despite comprehensive efforts by the first and second generation MESA interns. One nearly overlooked side effect was singularly outstanding and in keeping with experiences of others conducting mail-in questionnaire studies. Those who returned the questionnaire were distinctly different from those who didn't on one important criterion: they tended to complete the course eight times out of ten.

The emphasis on the pilot study had been on identifying individuals at registration time who might require extra attention in order to complete the course. This still remains a long term objective. However, the third generation MESA research intern (senior author) has picked up the task in a different manner and has concentrated on prediction of overall completion rates. After identifying key factors for predicting overall rates, we hope to work backward and establish non-obtrusive measures for estimating probabilities for individual completions. This study reports on our progress in predicting overall completion rates for various open learning courses given the demographic, curricular, and administrative conditions prevailing at the City Colleges of Chicago.

## BACKGROUND AND DEFINITIONS

Chicago's TV College is now beginning its twentieth year of providing open broadcast credit courses. It is part of a larger open learning system which includes course offerings by radio, newspaper, and videocassette in addition to open broadcast television. These courses use materials produced locally, leased from others, and recent PBS series adapted for college credit (Ascent of Man, Classic Theater, and Adams' Chronicles).

The student characteristics for the television courses are typical of open learning experiences elsewhere:

--60% female
--average age 32 years
--working at least part time
--50% are enrolled on campus as well as for television
--50% are taking a television course for the first time
--most take television courses out of necessity prompted by working, children at home, convenience, etc.

For purposes of this study, several definitions need to be kept in mind. Course completion is defined as achieving an A,B,C, or D grade at the conclusion of the 15 week semester. Incompletes (R) are treated as a withdrawal (W) to simplify our record keeping since students have two semesters to remove the R grade. There is typically a 10% incomplete rate with many incompletes reverting to W or F. Failure (F) is considered a withdrawal or unsuccessful completion of the course since the student receives no credit for an F grade.

The base enrollment figure for a course is the initial registration number rather than a mid-term or ten day figure. Thus we are treating gross enrollment figures rather than adjusted figures. This tends to inflate the withdrawal rate but is the only feasible measure since we cannot conduct a head count, as is possible in the classroom.

Using these criteria, a typical TV College course would have a 60% withdrawal figure. Previous TV College reports (Zigerell and Chausow, 1974) show lower withdrawal rates. While there has been a slow increase in withdrawal figures, the difference is partly explained by previous use of a two tier withdrawal accounting procedure. Official withdrawal occurs when the student files for withdrawal status. Unofficial withdrawal is recorded when the student does nothing after initial registration. We do not make this distinction here in order to simplify our accounting method and to more accurately describe withdrawal rates. Our approach also allows greater comparison across systems using different methods of defining withdrawals.

It has been a long standing practice for TV College students to complete an evaluation instrument early in the semester, as one of their course requirements. The one page questionnaire is given out at registration and returned at the end of the third week of the semester. This in-process procedure represents a type of formative evaluation (Scriven, 1967) where the results can be used to modify and improve a course while it is still in progress. This view is similar to those found at the University of Mid-America (see e.g. Gooler, 1975) and Coast Community College (see e.g. Ruth and Teraz, 1974). Unit evaluation forms, student diaries and interviews are respectively used to generate information to improve televised offerings.

Other telecourse systems depend upon only an end-of-course student evaluation instrument (see e.g. Telecourse Evaluation, 1975). This type of approach has been labeled as summative evaluation (Scriven, 1967) and involves judging the merits of a completed instructional sequence. While there are strengths and weaknesses in both of these types of evaluation, the formative approach encourages the researcher to examine data at an early stage of the course, which allows

modifications in subsequent units.

DEVELOPMENT OF THE PREDICTIVE FORMULA

With this general orientation in mind, the four TV College courses offered in the Spring 1975 semester (Child Development 101, Business 101, Economics 201, and Mathematics 111) were examined to determine if certain repetitions or patterns would surface. The analyses of the data from these courses have clearly illustrated that trends and patterns do exist and can serve as baseline information for later courses. Particularly noteworthy are the following three main factors (patterns):

(1) sex effect - female open learning students complete their courses more often than do their male counterparts,

(2) campus effect - open learning students who register at certain City College campuses consistently complete their courses more often than do students who register at other campuses, and

(3) questionnaire effect - students who complete and return an assigned student questionnaire are much more likely to complete their courses than are students who do not complete this assignment.

Two further secondary relationships have been found which involve the interaction of the sex and questionnaire variables:

(1) females who complete the questionnaire are more likely to complete their open learning course than are males who complete the questionnaire, and

(2) females who do not complete this instrument are more likely to complete their course than are males who do not submit the student questionnaire.

Using results from the baseline courses, a numerical value has been attached to each dimension of the factors described above. For example, 45% of all females and 56% of all males completing the questionnaire withdrew from their open learning course. Therefore, "weightings" or coefficients of .45 and .56 were assigned to female and male questionnaire groups respectively. Each factor was weighted according to the results from the combined baseline courses. These weighted variables were than used in formulas which, it was hoped, could accurately predict the total number of student withdrawals in subsequent open learning courses.

Two separate formulas were tested with a Music 121 course offered over radio. The first equation utilized a sex-by-questionnaire interaction formula. The second used the differential completion rates of students registered at the seven City College campuses.

The formulas are:

(1) Sex-by-Questionnaire Interaction

$$W = .85(NQ) + .56(MQ) + .45(FQ)$$

Where: W = the number of withdrawals
NQ = the number of individuals who did not complete the student questionnaire
MQ = the number of male students who completed the questionnaire
FQ = the number of female students who completed the questionnaire

(Numerical estimates are based on 1975 rates for withdrawals.)

(2) College of Registration

$$W = .791(KK) + .659(LP) + .949(MX) + .482(MF) + .835(OH) + .579(SW) + .544(WR)$$

Where: W = the number of withdrawals
KK = the number of students registered at the Kennedy-King campus
LP = the number of students registered at Loop campus
MX = the number of students registered at Malcolm X campus
MF = the number of students registered at Mayfair campus
OH = the number of students registered at Olive-Harvey campus
SW = the number of students registered at Southwest campus
WR = the number of students registered at Wright campus

(Numerical estimates are based on 1975 rates for withdrawals. Once again, each coefficient represents the percent of withdrawals for a given variable, i.e. sex, particular campus, those submitting questionnaires, etc.)

As the first trial, the number of students registered at each of the campuses for the Music 121 course was substituted into the campus-based formula. Likewise, the appropriate numbers of students were substituted into the sex-by-questionnaire formula. The results very closely fit the actual data. Based on the Official Class List submitted by the instructor at the end of the course, 69 out of 98 students did not complete Music 121. The sex-by-questionnaire formula predicted 66 withdrawals. The campus-based index estimated that 65 students would not complete the course. Thus, the estimates were 95.7% and 94.2% of the actual number of withdrawals for this course. These results were extremely encouraging and, as a result, a number of further trials have been undertaken.

The withdrawal equation has undergone a number of refinements which have continued to sharpen its predictive powers. The two separate formulas have been unified into one appropriately weighted index. Seperate male and female estimates have been generated for the students not completing the questionnaire. Finally, the coefficients have been updated by incorporating the results from 1976 open learning course data. Once this method of estimation is established, it is easily updated by incorporating subsequent findings into the baseline data

pool. The combined results then become the source of new coefficients used in the next round of predictions. This procedure is asymptotic in nature, in that its predictions will theoretically approach perfect accuracy as the number of observations increases indefinitely.

The following data provide results of the subsequent trials of the prediction equation: course number, medium of presentation, enrollment, estimate of non-completions, actual number of non-completions and a comparison of predicted to actual.

Business Law 211: (Locally Produced Television) - 453 registered students. The estimated number of non-completions was computed to be 286. The actual number of non-completions at the end of the course was found to be 298. The predicted number was 96% of the actual withdrawal figure.

Environmental Studies 102: (Half Local, Half Nationally-Oriented Television) - 596 registered students. Estimated non-completions = 370. Actual number of non-completions = 393. The predicted number was 94% of the actual withdrawal figure.

Political Science 201: (Locally Produced Television) - 316 registered students. Estimated non-completions = 202. Actual number of non-completions = 225. The predicted number was 79% of the actual withdrawal figure.

Psychology 201: (Nationally Distributed Television) - 500 registered students. Estimated non-completions = 343. Actual number of noncompletions = 339. The predicted number was 101% of the actual withdrawal figure.

Social Science 106: (Nationally Distributed Course-by-Newspaper) - 253 registered students. Estimated number of non-completions = 180. Actual number of non-completions = 173. The predicted number was 104% of the actual withdrawal figure.

Mathematics 111: (Locally Produced Television - eight week summer term) - 629 registered students. Estimated number of non-completions = 486. Actual number of non-completions = 537. The predicted number was 91% of the actual withdrawal figure.

Further trials beyond the Mathematics 111 course (Summer semester 1976) have not yet been completed.

The most recent version of the open learning withdrawal prediction formula is presented:

$$*W = (.89(MNQ) + .71(FNQ) + .56(MQ) + .45(FQ) + .823(KK) + .668(LP) + .908(MX) + .585(NE) + .871(OH) + .594(SW) + .577(WR))/2$$

Where: W = the number of withdrawals
MNQ = the number of males not submitting the questionnaire
FNQ = the number of females not submitting the questionnaire
MQ = the number of males submitting the student questionnaire

FQ = the number of females submitting the student questionnaire
KK = the number of students registered at Kennedy-King campus
LP = the number of students registered at Loop campus
MX = the number of students registered at Malcolm X campus
NE = the number of students registered at Northeast campus
OH = the number of students registered at Olive-Harvey campus
SW = the number of students registered at Southwest campus
WR = the number of students registered at Wright campus

(Based on 1975 and 1976 baseline studies.)

*This version of the formula consists of two main factors (a campus-based element, and a sex-by-questionnaire component) which appear to have an equal bearing upon the accuracy of the final prediction. The division by the number 2, in effect averages the influence given to each of the two factors. One of the main assets of this type of formulation is its adaptability. Any number of additionally identified components can be added on, and their weight can be easily adjusted by the inclusion of an appropriate divisor.

## OBSERVATIONS FROM FINDINGS

While the effectiveness of the individual predictions have varied slightly from course to course, they are, on the whole, quite accurate. Of the eight trials of the withdrawal equation (with seven different open learning courses), seven estimates have been within ± 10%. Six of the eight estimates have been within ± 6%. Considering the wide diversity in course content and delivery mode, the demonstrated effectiveness of the withdrawal equation is seen as very encouraging. A striking observation about the present findings is that course delivery mode appears to be quite independent of student withdrawals. The same predictive formula seems to apply equally well to courses presented via different media. It is quite possible that the withdrawal variable is not very highly related to the delivery mode, as long as the courses are produced at a given level of attractiveness and are not overly demanding of written assignments, prerequisites, etc. These results lend some credence to the view that prior educational experiences, administrative concerns, and other nonmedia-related components may be as important as a course's media component.

## USES FOR METHODOLOGY AND DATA

The value of accurate prediction of final course completion rates is not simply an evaluator's exercise. Planning is underway for developing open learning counseling services. These services would actively and aggressively help the open learning student complete his or her courses, or persuade students unsuited for such courses to look for other opportunities. Such services are currently offered under the Study Unlimited program which places videocassettes of TV College and other courses in selected Chicago Public Library branches. Counseling

services are expensive and require careful management.

The conventional way to test a new idea is to establish experimental and control groups based upon random assignment. To test the open broadcast counseling effort in this manner would be very difficult. Fairness to students, adequate control, administrative problems of separating two groups, and other issues would be impossible barriers for conducting good research. We can compare the final course figures after using counseling services with predicted figures which assume no intervention. This simulates an experimental design. Cost/effectiveness and cost/benefit analyses could be determined in this manner if credence is given to the withdrawal formula.

Another use of the data for decision making is the flagging of courses which perform above or below the expected completion rate. A departure from the prediction would indicate strength or weakness in the instructional design of individual courses. This assumes that courses share common administrative procedures, scheduling, and services. An example of such a course is Political Science 201. This course has a 15 percentage point difference below the average estimate. (79% vs. 94%). Followup studies by phone interviews have not been made but analysis of student questionnaires suggests problems with the television presentation. The course is comparatively old, the instructor may have alienated some students, and the number of assignments may have been excessive. In any case, the weaknesses in a course's instructional design can be determined by first noting a lower expected completion rate. This can be followed by evaluation of the course components.

Another example of course flagging came with Mathematics 111. This course was offered in an eight week summer session rather than the normal 15 week semester. We hypothesize that a "summer" effect may occur in accelerated courses. This causes withdrawal by some students who might be expected to complete an ordinary semester course. The "summer effect" would then skew our data toward higher than expected withdrawals. This explanation assumes that there was satisfactory course design and administration. Other evaluative procedures would confirm or deny this assumption.

The practical administrative uses of the formula and the data generated from it are numerous:

--predicting the course load for instructors and thereby adjusting their work load accordingly;

--the number and size of examination rooms can be planned in advance along with proctor requirements;

--campuses which register TV students having low performance can be singled out for special attention.

## FUTURE REFINEMENTS

We noted at the outset that our goal was to predict an individual's probability for completion of open learning courses. Prediction of overall rates is one step toward that goal. We now feel that it would be feasible to develop a technique for classifying students according to their "risk" of withdrawing. This would mean establishing a matrix of

relevant characteristics and combinations of characteristics sensitive to predicting withdrawal. At registration time (or shortly thereafter), high, medium and low risk groups could be designated. Those in the high risk groups could be contacted individually and receive the necessary counseling to determine the students' home situation, prior educational background, and interest in the course.

Those in the lower risk groups might require attention and encouragement toward the end of the course and at examination times. The load for the counselors could be spread out over the course by concentrating on the high risk groups at the beginning. As the inevitable withdrawals take place, they could pick up the slack with the lower risk groups toward the end when assignments and the final examinations loom large.

We are attempting to use the tools of evaluation and research to provide for individual needs in what has become a very massive and necessarily more impersonal learning environment classroom. Personal attention could be focused on those students identified as requiring supportive services. Yet these added services require oversight by good management and attention to costs.

We know little about the learning habits and cognitive styles of mature adults--particularly where self-study and educational media are involved. While we have found that the delivery mode does not seem to be a major factor in our predictions, it is with some unease that we let the issue go unexplored. Perhaps others could also pursue the complex relationships which are at work with the help of the modest technique discussed in this report.

## SUMMARY

This study describes a method of accurately estimating open learning course completion rates based upon non-obstrusive measures made at the beginning of courses. The prediction formula is not dependent upon a particular delivery mode since the same formula was applied with equal precision to radio, newspaper, and open broadcast television courses. The common threads which ran through the courses were: paced rather than self-paced instruction, similar administrative procedures, and roughly equivalent student demographic characteristics.

The uses for an accurate overall estimate of course completion rates are primarily administrative. The goal of predicting individual completion probabilities, however, is to serve the students better. When counseling is made available as early in the course as possible, we would hope that the sense of anonymity inherent in mass education techniques can be counterbalanced with human concern for the individual.

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